CEDAR RIVER BRIDGE
Iowa Bridges Recording Project
Spanning over the Cedar River
on county road T42,
5.8 miles North West of Floyd
Floyd Vicinity
Floyd County
Iowa

HAER No. IA-80

BLACK & WHITE PHOTOGRAPHS

WRITTEN HISTORICAL & DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Department of the Interior
P.O. Box 37127
Washington, D.C. 20013-7127

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# HISTORIC AMERICAN ENGINEERING RECORD

## CEDAR RIVER BRIDGE

HAER No. IA-80

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| Location: | Spanning the Cedar River on county road T42, 5.8 miles northwest of Floyd, Floyd County, Iowa<br>USGS: Section 24, Township 97 North, Range 17 West |
| Date of Construction: | 1936 |
| Designers: | Iowa State Highway Commission |
| Builders: | Unknown |
| Fabricators: | Unknown |
| Present Owner: | Floyd County |
| Present Use: | Roadway |
| Significance: | Designed by the Iowa State Highway Commission. The continuous steel girder of three spans maintains its original Art Deco railing. |
| Historians: | Richard Vidutis, James Hippen |
| Project information: | This document was prepared as part of the Iowa Historic Bridges Recording Project performed during the summer of 1996 by the Historic American Engineering Record (HAER). The project was sponsored by the Iowa Department of Transportation (IDOT). Preliminary research on this bridge was performed by Clayton B. Fraser of Fraserdesign, Loveland, Colorado. |

INTRODUCTION

Located on a valley road which parallels the Cedar River in the middle of some of Iowa's richest agricultural land, the Cedar River Bridge provides a crossing on a northwest-southeast diagonal road along the Cedar River Valley through Mitchell and Floyd Counties. The road heads southeast to Charles City (the largest city in Floyd County) and beyond to Waterloo on U.S. State Highway 218.

The Cedar River Bridge replaced an earlier 110' wooden truss which had collapsed in 1935. Plans were developed by January 1936 for a 350' continuous deck plate girder bridge of four spans. Built during depression days, it stands today in excellent condition as an example of the many fine bridges built during the 1930s in Iowa and reflects the evolution of design from concrete to steel, from multi-span to continuous structures.

I. REGIONAL HISTORY

The boundaries of Floyd County were defined on January 15, 1854, and in 1879 Rudd Township was set off. The only town existing in this township was Rudd, which was laid out and platted in the fall of 1869.[1]

The Cedar River enters Iowa from Minnesota in Mitchell County at a distance of 292.2 miles from the Mississippi. The Cedar River Bridge is located on a county road which parallels the Cedar River. The southeast-northwest diagonal valley road joins state road 218 in Floyd, continues on to Charles City (the most populous town between Austin, Minnesota and Cedar Falls, and on to Waterloo. The Cedar crossing is right in the middle of an agricultural area being about six miles equidistant from Floyd to the south and Osage in Mitchell County to the north. The largest tributary of the Cedar is the Shellrock River. Together the two broad river valleys, and their numerous tributaries, contain some of the richest land in the Hawkeye State. Most of Worth, Cerro Gordo, Franklin, Butler, and Floyd counties are part of this area. Corn and oats are the principal crops but the area is probably best known for its dairying; Shellrock Valley is the western limit of Iowa's dairy area.[2] North of the Cedar River Bridge, in Mitchell County, the Cedar flows past Otranto with its valuable ginseng arbor, then past St. Ansgar, a Czech community

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[1]Clement L. Webster, History of Floyd County, Iowa (Charles City, Iowa: Intelligencer Print, 1897), p. 28.

[2]William J. Petersen, Iowa: The Rivers of Her Valleys (Iowa City: State Historical Society of Iowa, 1941), p. 125.

founded in 1853.[3] During the years when wheat flourished in Iowa, Mitchell County had many mills along the Cedar: at Otranto, Newburg, St. Ansgar, Mitchell, and Osage. In 1855 the early pioneers built a dam across the Cedar not far from Otranto for milling purposes, and by 1890 three mills had been erected there.[4] (See Fig.1, Appendix B)

The Cedar River Bridge area never developed into a large town or city but remained a prosperous rural community which evidently had the political and financial clout in the Depression to organize and build such an expensive structure.

## II. THE HISTORY, DESIGN, AND TECHNOLOGY OF THE CEDAR RIVER BRIDGE

The earlier structure at the Cedar River crossing was a two-span 110′ wooden truss erected on stone piers and abutments. In August 1935 the south truss failed, and, consequently, the north truss was removed. The construction date of the earlier crossing is not known, but a plan and profile sheet for the crossing was drawn up in April 8, 1920.

A plan and profile sheet found at the Iowa Department of Transportation in Ames suggests a design sequence which considered three different alternatives for the replacement of the collapsed wooden truss over the Cedar River. The first alternative (undated, but voided August 20, 1935) shows a two pier bridge of unspecified length or type placed at a southwest angle from the earlier bridge. The second alternative is dated August 20, 1935 (and voided September 2, 1935) and shows a 390′ continuous beam, 85′-110′-110′-85′ placed at a 47 degree angle northeast from the earlier wood truss. And the final alternative (with no design dates) was a 350′ continuous plate deck girder with proposed spans of 77′-98′-98′-77 placed at a 62 degree angle northeast of the original crossing. The entire sheet with the three alternatives was voided November 8, 1935.[5] (See Fig.2, Appendix B) In January 1936 the design plans for the current Cedar River Bridge were drawn up. It was placed at an angle to the original crossing. (See Fig.3, Appendix B)

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[3]Ibid., p. 127.

[4]Jacob A. Swisher, Iowa: Land of Many Mills (Iowa City: State Historical Society of Iowa, 1940), p. 114.

[5]Design plan: *Plan and Profile*. Floyd-Orchard Road. Floyd County. At Crossing of Cedar River. April 8, 1920.

Two major types of bridges are used extensively in Iowa in the late twentieth century for medium and large spans. These are the continuous steel girder and the precast, prestressed concrete girder. The prestressed girder has come into use since World War II, but the continuous girder bridge has a long history. The technology of the Cedar River Bridge represents an important step in the evolution of this technology from experimental to common use.

The continuous beam, girder, or truss bridge has the advantage over simply supported structures in a saving of material and greater stiffness.[6] This was demonstrated on a grand scale by Robert Stephenson's Britania Bridge, completed in 1850.[7] American engineers, however, were slow to adopt the idea of continuity in a bridge, considering it impractical both because of its vulnerability to the effects of any pier settlement and the difficulty of calculating the stresses involved.[8] Some very few examples were built in North America, and the theory found its way into textbooks, but the attitude of the great majority of engineers was summed up, and fortified, by J.A.L. Waddell (the pontifex maximus of the profession) who concluded "few American engineers will countenance the building of continuous girder bridges."[9] In 1917, the next year, Gustav Lindenthal completed the great Sciotoville, Ohio, continuous truss, and engineers slowly began to realize the practical possibilities in the continuous approach.[10]

In Iowa, as in the profession generally, engineers approached the previously condemned idea with care. In trusses and in girders the nearest thing to a continuous structure is a cantilever. For major bridges, such as crossings of the Mississippi and Missouri rivers, cantilever trusses had been used for decades. The first large continuous truss was the Nebraska City Bridge over the

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[6]The principle of continuity is clearly explained in Harry Parker, Simplified Design of Reinforced Concrete (New York: Wiley, 1943), chapter 3, and later editions of the same work.

[7]Charles Singer, et al. A History of Technology, 5 The Late Nineteenth Century (Oxford: Clarendon Press, 1958), pp 504-505.

[8]George A. Hool and W.S. Kinne, Movable and Long-Span Steel Bridges, 2nd ed. (New York: McGraw-Hill, 1943), pp. 199-201.

[9]Bridge Engineering I (New York: Wiley, 1916), p. 482.

[10]Carl W. Condit, American Building Art: The Twentieth Century (New York: Oxford University Press, 1961), pp. 92-100.

Missouri, built in 1929.[11] Others were built in the 1930s over the Mississippi, the Missouri, and the Des Moines rivers.

Of wider importance throughout the state was the gradual acceptance of continuous bridges for moderately large crossings. The first, so far as is known, was designed by the highway commission to replace a Luten patented arch that had collapsed in Ames. Built to carry the Lincoln Highway over Squaw Creek, the bridge was a three-span steel through plate girder, and it was continuous. The inflammatory word "continuous" was not used, however, in describing the bridge. The captions to published photographs merely call attention to the beauty of the "continuous curve" of the camber of the bridge, "instead of a series of lines breaking at the pier points."[12] Also noted is the fact that the three girders are "permanently connected to each other end to end," thus saving in the number of supports needed on the top of the piers.[13] If this seems to press the issue of disguising the new a bit far, it is well to note that when the state highway system was established two years earlier, "so great was the opposition to the word 'state' and a state-controlled road system, that legislators, fearing for their political futures, names it the 'Primary Road System'."[14]

The cantilever design was also used first with regard to concrete structures. As early as 1905, a concrete cantilevered girder was built for the street railway in Marion.[15] The highway commission experimented with reinforced concrete cantilever girders, beginning with one at Woodbine (also on the Lincoln Highway) in 1917. Others followed, noted in the bridge design section of the commission's Annual Reports.[16] In 1926 the commission reported the design of a "monolithic concrete girder" that "makes use of

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[11]Sverdrup & Parcel, Engineering Projects (St. Louis: 1946).

[12]Iowa State Highway Commission, Service Bulletin 9 (March-April, 1921):3.

[13]Ibid., p. 5.

[14]William Thompson, Transportation in Iowa: A Historical Summary (Ames: Iowa Department of Transportation, 1989), p. 73.

[15]This may have been the first such bridge in the nation. Carl Condit, American Building (Chicago: University of Chicago Press, 1968), p. 257.

[16]Those listed in Fraserdesign, Iowa Historic Bridge Inventory (1993), are Herrold, 1921 (POLK13), Goldfield, 1921-22 (WRIG27), Okoboji, 1929 (DICK01), and Spirit Lake, 1939 (DICK02).

the cantilever principle."[17] This was the Winnebago River Bridge (HAER No. IA-78) just north of Mason City.

But things began to change more rapidly. Other states were also introducing the continuous bridge.[18] By 1929 an editorial in the Engineering News-Record could proclaim that "structural views have made distinct progress since the days when continuous bridges were considered bad practice."[19] Iowa began to regularly construct continuous bridges, usually of the steel plate girder variety.[20] Those that were built in the 1930s are remarkable examples of innovative design in response to the demands of the age of automobiles and highways.

The Cedar River (also called Red Cedar River) Bridge was built in 1936 as a result of the collapse a year earlier of one span of a wood truss at the crossing. The present bridge is a 350' deck plate girder bridge of four spans. It is a continuous structure, with the span proportioned 75'-100'-100'-75' in length.[21] It is one of the numerous fine bridges, including many continuous bridges, built in the state in the 1930s. Iowa fit the national trends. Shortridge Hardesty of Waddell & Hardesty, Consulting Engineers, in reviewing bridge engineering for the year 1936 noted that "there was a large volume of moderate-sized and small bridge work under way during the year, much of it with the aid of PWA and other federal money."[22] Albin L. Gemeny, Senior Structural Engineer, U.S. Bureau of Public Roads, noted a year later that "there was a continuing inclination among engineers

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[17]Iowa State Highway Commission, Annual Report for 1926, p. 15.

[18]Oregon State Highway Commission, Eighth Biennial Report...1926...1928 (Salem, Oregon: 1929), p. 71.

[19]Ibid., January, 17, 1929, p. 89.

[20]The conclusion that few concrete continuous bridges were built is tentative. The Iowa Historic Bridge Inventory rarely identifies continuous structures, so it is of little value in checking among the surveyed items for this structural type. From an economic point of view, concrete continuous girders, due to cost of formwork, would usually be more expensive, thus less common. The concrete bridge really came into its own with the introduction of prestressed beams after World War II.

[21]Design for 350 ft. Deck Plate Girder Bridge, January 1936, Iowa Department of Transportation file no. 10725.

[22]Engineering News-Record 118 (February 4, 1937):178.

toward the use of steel, instead of concrete, for structures where these two materials were competitive." And he made two other points which accurately describe the Cedar River Bridge. Gemeny wrote that "in the field of steel bridges multiple simple spans have almost gone into the discard. Continuous beam and girder spans are being generally adopted for intermediate lengths." Finally Gemeny recognized that "insistence on esthetic merit reached its full strength during the past year."[23]

The technical aspects of the Cedar River Bridge have already been noted as fitting these trends. What is particularly interesting is that this bridge, near the edge of the county and on a road that is not even paved to this day, demonstrates a superb balance between ornamentation and structural honesty.

The three girders, spaced 9'-6" on centers, are built up from plates and angles; the parts are connected with rivets. The concentration of stress over the piers is revealed both by an increase in the depth of the girder and angle web bracing in the same area. The girders achieve their depth with a gentle curve downward, just touching, with a seeming lightness, the rocker bearings on the top of the piers. At the points of inflexion, where the slice plate are, the girders return to parallel flanges and the only interruptions to the surface are the lines of rivets which secure the floor beams. The deck and railing is solid, no Beaux Arts balusters, with a very restrained incised Art Deco ornament. The Cedar River Bridge, apart from the usual graffiti, is in excellent condition. It is a testimony to the vigor of the engineering profession even in the difficult days of the Depression.

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[23]Ibid., 120 (February 10, 1938):233.

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APPENDIX A Bridge Designs for the Cedar River Bridge

Microfilm files located at the Iowa Department of Transportation, Ames, Iowa. Filed under: File 10725, Design 136.

1. *Design for 350 Ft. Deck Plate Girder Bridge. 20' Roadway. Concrete Floor and Handrail. 4 Span Continuous 75'-100'-100'-75' Over Red Cedar River.* Station 10+50. County Project. ISHC. January 1936. Design No. 136. File No. 10725. [4 sheets]

2. *Profile of Pro. Br. Site* from large topographic rec'd from Co. Eng. 11-18-35. Pro. Br.= 75'-100'-100'-75', 20' Rdy. Contin. IB. [1 sheet]

3. *Plan and Profile.* Floyd-Orchard Road. Floyd County. At Crossing of Cedar River. April 8, 1920. [1 sheet]

4. An untitled topographic map of the new proposed bridge site. No date. [1 sheet]

APPENDIX B List of Illustrations

Fig.1 Map of Upper Cedar River Valley. From William J. Petersen, Iowa: The Rivers of Her Valleys. Iowa City: State Historical Society, 1941, p. 121.

Fig.2 From design plan: *Plan and Profile,* showing placement of the three proposed bridge alternates. April 8, 1920.

Fig.3 From design plan: An untitled topographic map of the new proposed bridge site. No date.

Fig.4 Profile sketch of the Cedar River Bridge. James Hippen, 1996.

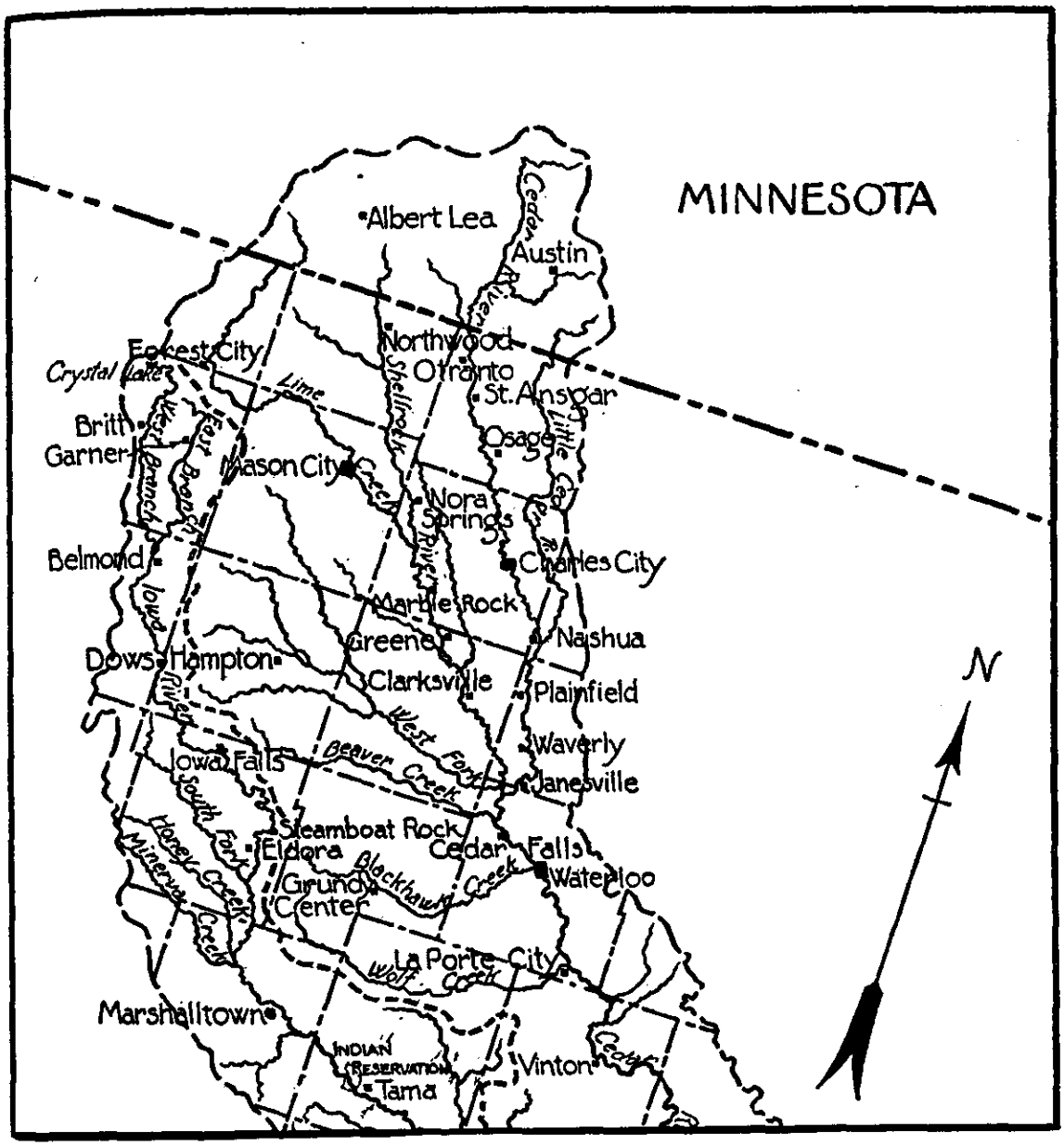


Fig 1 Map of Upper Cedar River Valley.

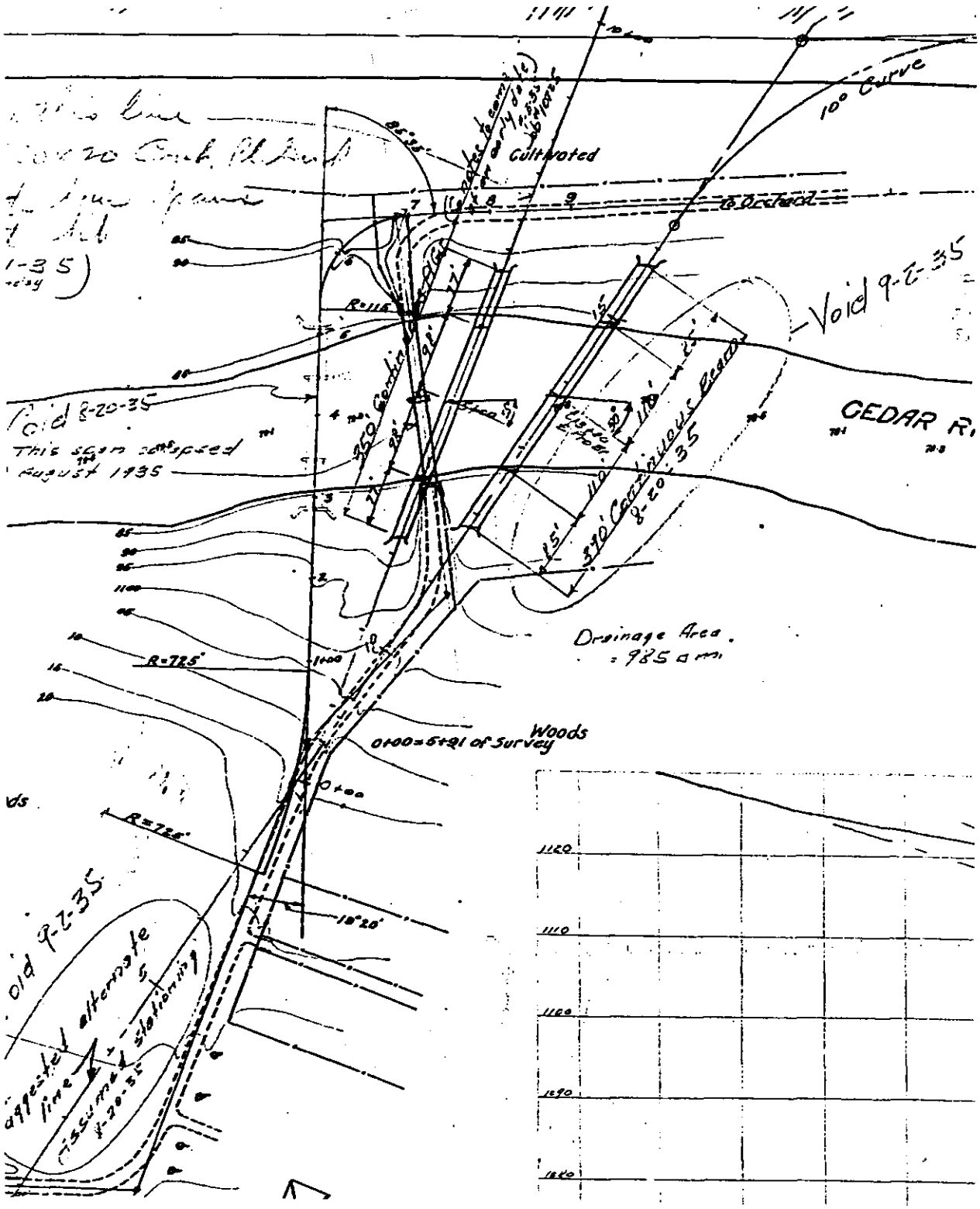


Fig.2 From design plan: *Plan and Profile*, showing placement of the three proposed bridge alternates.

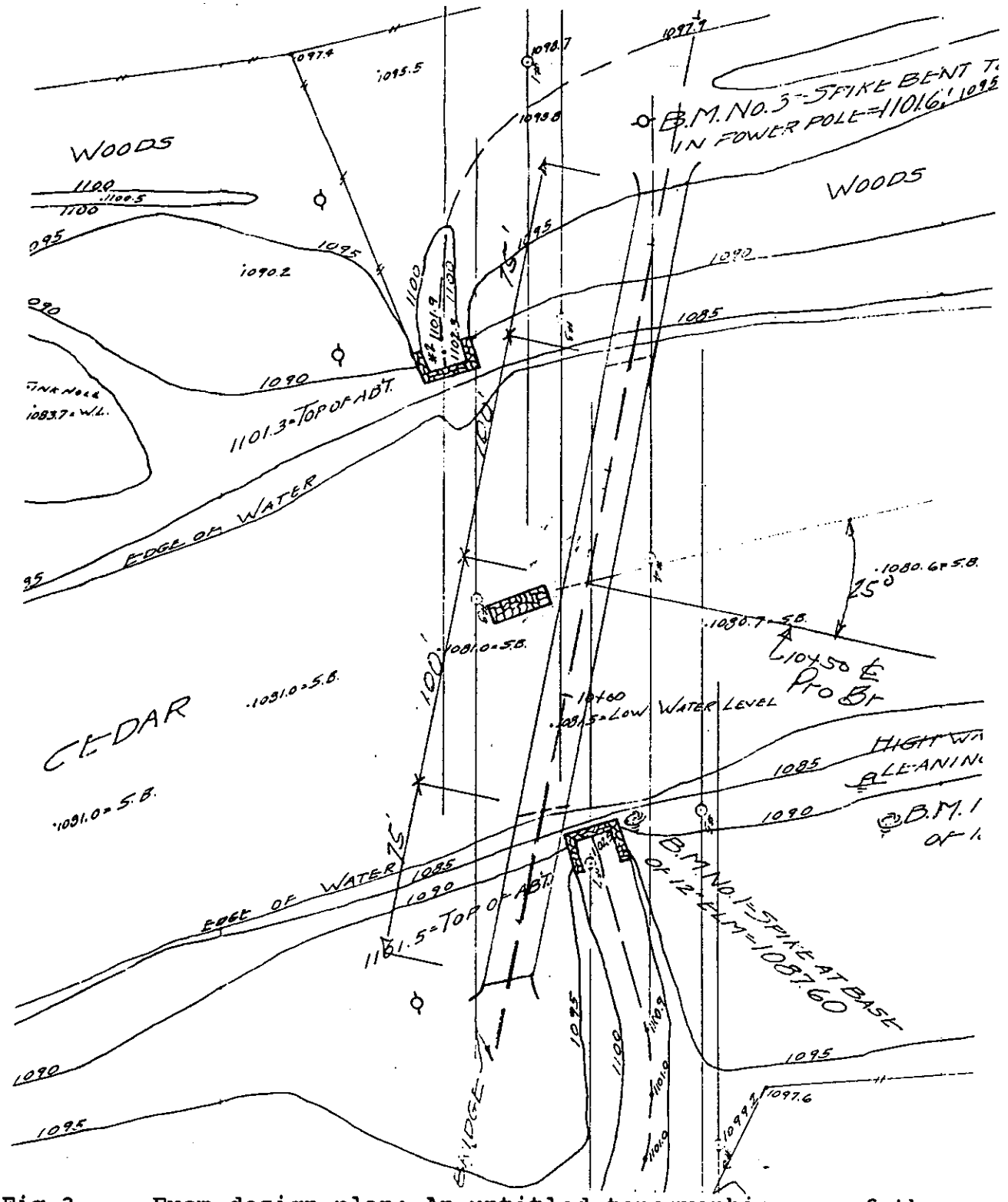


Fig.3 From design plan: An untitled topographic map of the new proposed bridge site.

# CEDAR RIVER BRIDGE

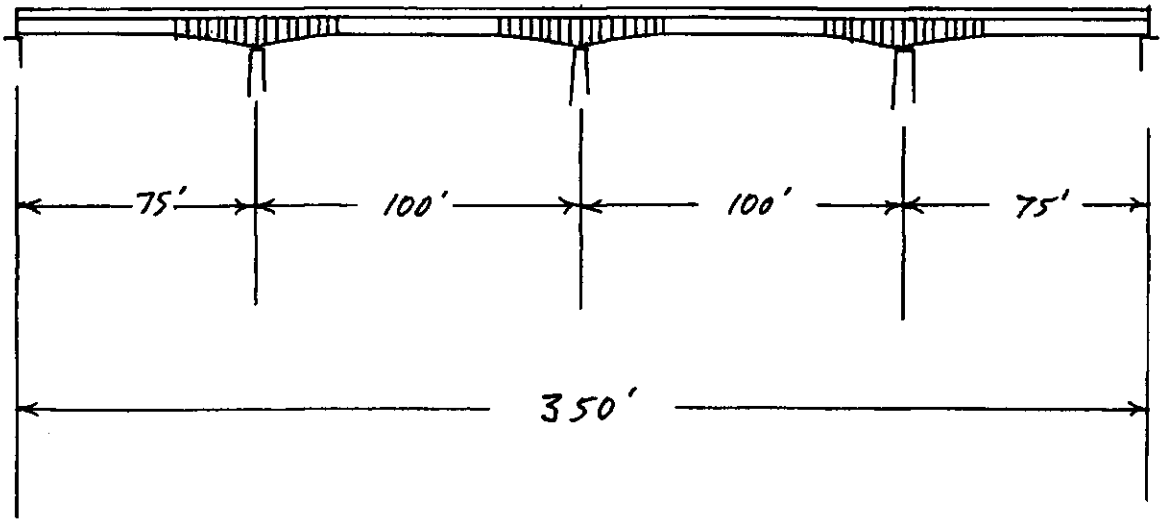


Fig.4 Profile sketch of the Cedar River Bridge. James Hippen, 1996.

## APPENDIX C Research Statement

### Research Limitations

The only documentation found on the Cedar River Bridge were design plans located at the Iowa Department of Transportation in Ames.

### Future Directions for Researching the Bridge

Historical societies and local libraries should be contacted and searched for possible historic photos in their collections.

ADDENDUM TO
CEDAR RIVER BRIDGE
Iowa Historic Bridges Recording Project II
Spanning Cedar River at County Road T42
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Floyd County
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CEDAR RIVER BRIDGE

This appendix is an addendum to a 15-page report previously transmitted to the Library of Congress.

## APPENDIX: ADDITIONAL REFERENCES

Interested readers may consult the Historical Overview of Iowa Bridges, HAER No. IA-88: "This historical overview of bridges in Iowa was prepared as part of Iowa Historic Bridges Recording Project - I and II, conducted during the summers of 1995 and 1996 by the Historic American Engineering Record (HAER). The purpose of the overview was to provide a unified historical context for the bridges involved in the recording projects."